

515-99067-TS (1)



PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

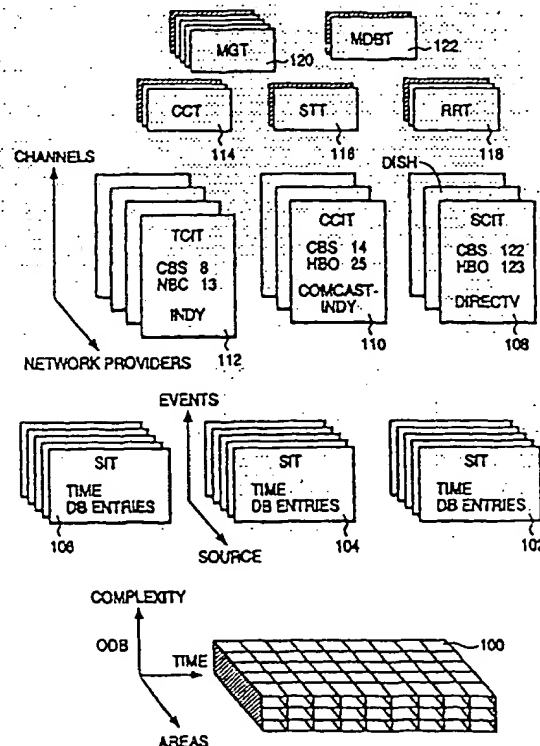
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : H04N 7/16		A1	(11) International Publication Number: WO 99/43160
			(43) International Publication Date: 26 August 1999 (26.08.99)
(21) International Application Number: PCT/US99/03513		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 18 February 1999 (18.02.99)		Published With international search report.	
(30) Priority Data: 60/075,412 20 February 1998 (20.02.98) US			
(71) Applicant (for all designated States except US): THOMSON CONSUMER ELECTRONICS, INC. [US/US]; 10330 North Meridian Street, Indianapolis, IN 46290 (US).			
(72) Inventors; and (75) Inventors/Applicants (for US only): OZKAN, Mehmet, Kemal [TR/TR]; Savasci Sok. Bozokatt 19/1, Avcilar, 34840 Istanbul (TR). TENG, Chia-Yuan [-/US]; 7384 Celata Lane, San Diego, CA 92129 (US). HEREDIA, Edwin, Arturo [BO/US]; Apartment 4015, 8274 Lakeshore Circle, Indianapolis, IN 46250 (US).			
(74) Agents: TRIPOLI, Joseph, S. et al.; Thomson Multimedia Licensing Incorporated, P.O. Box 5312, Princeton, NJ 08540 (US).			

(54) Title: A MULTIMEDIA SYSTEM FOR ADAPTIVELY FORMING AND PROCESSING EXPANSIVE PROGRAM GUIDES

(57) Abstract

A program guide information data structure and processing system for processing large quantities of guide information facilitates achieving a desirable compromise between transmission bandwidth and decoder complexity. A decoder acquires data for collating program guide information including objects by both area (e.g. a geographic, broadcast, or network market area), and by scheduled time of broadcast. The decoder collates the program guide information using the collation data which comprises channel and program map information for associating the program guide information with particular areas and broadcast times. The decoder collates the program guide information to provide a program guide selected from at least two available program guides associated with different areas in response to a User selection input. The collated program guide information is processed for display.



*FOR THE PURPOSES OF INFORMATION ONLY*

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

5       A Multimedia System for Adaptively Forming and  
Processing Expansive Program Guides

*Field of the Invention*

10               This invention is related to the field of digital signal processing, and more particularly to program guides for channels and programs.

*Background of the Invention*

15               The formation and processing of large program guides conveying information concerning potentially thousands of broadcast program channels covering a wide geographic area poses a number of problems. The geographic area covered may  
20 encompass the whole of the USA or whole continents, for example, and large quantities of information may have to be acquired, collated, encoded and broadcast in a format that facilitates subsequent decoding of the broadcast material. The bandwidth required to process such large quantities of information expands  
25 in proportion to the quantity of information being processed. Therefore, there is a need to structure program guide data in order to optimize the use of the available bandwidth.

              The degree to which the program guide data structure may be optimized is constrained by the cost of a decoder unit for  
30 receiving the structured data. In fact there is a compromise to be made between transmission bandwidth and decoder complexity. At one extreme of the compromise, all duplicative and redundant data elements in the program guide information are eliminated in order to minimize the required transmission and processing  
35 bandwidth. As a result, each decoder needs to receive, buffer, parse and collate information from an entire program guide datastream, thereby necessitating a complex and costly decoder.

              At the other extreme of the compromise, the program guide information is partitioned into individual sub-sets tailored  
40 to the requirements of a particular User or group of Users. This

2

5 means that each decoder needs to receive, buffer, parse and  
collate targeted information containing minimal redundancy which  
facilitates employing a simpler, more economical decoder  
requiring less processing power. However, such partitioning  
requires a larger transmission bandwidth to accommodate the  
10 increased information redundancy resulting from the need to  
incorporate duplicate program guide information items in multiple  
different program guide sub-sets corresponding to different  
partitions. The problems involved in processing large quantities of  
program guide information and in achieving a desirable  
15 compromise between transmission bandwidth and decoder  
complexity are addressed by a system according to the present  
invention. Derivative problems involved in structuring and  
partitioning program guide data to facilitate both decoding and  
selectable program guide generation by a decoder are also  
20 addressed by a system according to the invention.

### *Summary of the Invention*

A decoder acquires data for collating program guide  
25 information including objects by both area (e.g. a geographic,  
broadcast, or network market area), and by scheduled time of  
broadcast. The decoder collates the program guide information  
using the collation data which comprises channel and program  
map information for associating the program guide information  
30 with particular areas and broadcast times. The decoder collates  
the program guide information to provide a program guide  
selected from at least two available program guides associated  
with different areas in response to a User selection input. The  
collated program guide information is processed for display.

35

### *Brief Description of the Drawings*

In the drawing:

3

5           Figure 1 shows a very large program guide (VLPG) hierarchical file/table format for use in conveying program specific information, according to the invention.

          Figure 2 shows a Master Guide Table (MGT) format for  
10 use in conveying program specific information, according to the invention.

          Figure 3 shows a Channel Information Table (CIT) format for use in conveying program specific information  
15 incorporating area based partitioning, according to the invention.

          Figure 4 shows a multimedia object data structure format incorporating area and time based partitioning, according  
to the invention.

20

          Figures 5, 6 and 7 show examples of data structures for channel, event and control object basic information files, according to the invention.

25           Figure 8 shows a data structure for an MPEG compatible carouselId (as used in the tables of Figures 5, 6 and 7) including identifier fields allowing area and time based partitioning.

30           Figure 9 shows a Master Database Table data structure format incorporating hierarchical based version identifiers and cell partition identifiers supporting dynamic program guide re-partitioning, according to the invention.

35           Figure 10 shows an exemplary data structure for a cell type indicator (as used in the table of Figure 9) incorporating area, time and complexity based identifier fields, according to the invention.

4

5           Figure 11 shows a hierarchical directory format for an object database including channel, event and control sub-directories, according to the invention.

          Figure 12 shows a method for generating program  
10 specific information according to the invention.

          Figure 13 is a block diagram of digital video receiving apparatus for demodulating and decoding broadcast signals containing VLPG information, according to the principles of the  
15 invention.

#### *Detailed Description of the Drawings*

          Broadcast programs transmitted in digital format are  
20 encoded and broadcast along with ancillary information including program specific information (PSI) used in decoding programs and associated data. Program specific information includes program guide data and information for use in identifying and assembling individual data packets to recover the content of selected program  
25 channels. Program specific information and associated program content is advantageously structured to convey large program guides conveying information concerning potentially thousands of broadcast program channels and associated multimedia objects covering a wide geographic area such as whole continents,  
30 countries or states, for example. The multimedia objects include audio clips, video clips, animation, still images, Internet data, Email messages, text and other types of data. Multimedia objects are data entities that may be viewed as independent units and are associated with images within individual programs or with  
35 program guide components. The multimedia objects are incorporated into composite video images representing a program guide or a video program, for example. The ancillary information data structure supports uni-directional communication applications e.g. passive viewing and bi-directional communication

5 applications e.g. interactive type functions and also supports storage applications.

The program specific information and associated program content may be delivered by different service providers via the Internet in broadcast/multicast mode, or via terrestrial,  
10 satellite or cable broadcast on a subscription or other pay per view basis. The data structure facilitates acquisition and decoding of multimedia objects encoded in different data formats and which are communicated in different communication protocols from both local and remote sources.

15 Hereinafter, data referred to as being MPEG compatible conforms to the MPEG2 (Moving Pictures Expert Group) image encoding standard, termed the "MPEG standard". This standard is comprised of a system encoding section (ISO/IEC 13818-1, 10th June 1994) and a video encoding section (ISO/IEC 13818-2, 20th  
20 January 1995).

Data structure elements according to the invention principles may be conveyed in MPEG compatible format (per section 2.4.4 of the MPEG systems standard) or may be conveyed in a format compatible with the *Program and System Information*  
25 *Protocol for Terrestrial Broadcast and Cable*, published by the Advanced Television Systems Committee (ATSC), 10 November 1997, hereinafter referred to as the PSIP standard, or other ATSC standards. Further, the data structure elements may be formed in accordance with other MPEG standards such as the MPEG-4 or  
30 MPEG-7 standards or with the proprietary or custom requirements of a particular system.

The principles of the invention may be applied to terrestrial, cable, satellite, Internet or computer network broadcast systems in which the coding type or modulation format  
35 may be varied. Such systems may include, for example, non-MPEG compatible systems, involving other types of encoded datastreams and other methods of conveying program specific information. Further, although the disclosed system is described as processing broadcast programs, this is exemplary only. The term 'program' is  
40 used to represent any form of packetized data such as audio data,

5 telephone messages, computer programs, Internet data or other communications, for example.

Figure 1 shows an overview of a very large program guide (VLP) hierarchical file/table format for use in a transport stream level data structure conveying program specific  
10 information. The structure comprises multiple hierarchically arranged and inter-linked tables. The tables consist of arrays of data and parameters which are used to enumerate and describe collections or sequences of TV channels, TV programs, channel parameters, program parameters, associated multimedia objects  
15 and object parameters, etc. The exemplary hierarchical table arrangement of Figure 1 includes a Master Guide Table (MGT) 120, Master Database Table (MDBT) 122, Content and Classification Table (CCT) 114, System Time Table (STT) 116 and Rating Region Table (RRT) 118. The Figure 1 hierarchy also shows Terrestrial,  
20 Cable and Satellite Channel Information Tables (TCIT item 112, CCIT item 110, and SCIT item 108 respectively) in which channel information is collated by network provider e.g. CBS, NBC, HBO, Comcast etc. Additional tables include Schedule Information Tables (SIT 106, SIT 104 and SIT 102) in which programs or  
25 services are collated by source.

A MGT contains information for use in acquiring program specific information conveyed in other tables. A channel information table - CIT (e.g. TCIT, CCIT, OR SCIT) contains information for tuning and navigation to receive a User selected  
30 program channel. A SIT contains descriptive lists of programs (events) receivable on the channels listed in the CIT. Either a CIT, SIT or other table may be used to convey information enabling a user to select and tune to a particular program. A CIT is typically used to convey parameters for acquiring audiovisual program  
35 content data that remains constant over several events (TV programs). An SIT is typically used to convey parameters of audiovisual program content data that remain constant for an event (individual TV program). Additional program specific information describing and supplementing items within the



5 hierarchical tables is conveyed within descriptor information elements.

In order to accommodate data sufficient for a wide area program guide, individual tables in the hierarchy of Figure 1 are advantageously partitionable by both area (e.g. a geographic, 10 broadcast, or network market area), and scheduled broadcast time. In addition, the table data may be additionally partitioned in accordance with a third parameter such as the complexity level of data or a multimedia object in order to permit scalability in decoding, for example. This type of program guide partitioning is 15 represented by the 3-dimensional cells depicted in diagram 100. In fact, the VLPG structure of Figure 1 supports virtually any type of partitioning that a guide provider may require. The area and time based partitioning is achieved by including both time and area identifiers in one or more of the tables of Figure 1 and in 20 associated object data. The advantage of including the area and time partition identifiers in the transport level of the communication protocol in this manner is that it reduces the processing burden (e.g. for parsing the data) on a decoder that otherwise occurs if the partitioning is done at a higher level, say 25 the Application layer level. As a result program guide filtering is done at the transport layer and is performed directly by a transport chip contained in a decoder unit. However, it is possible to include the time and area identifiers for both table data and objects at such a higher level if desired.

30 In transmitting and processing a program guide, the bandwidth demand grows with the quantity of channel and program information and number of associated objects that need to be transmitted. For a large program guide, even a simple case may require transmission of thousands of items of information 35 and objects. A simple program guide may have neither images, nor audio, nor video clips, but would still need at least text descriptions for the thousands of programs (events) that it carries. It is possible to send the program guide information without redundancy and without partitions in a single bin or data file. In 40 such a case, and in the absence of transport-level partitions, the

5 text descriptions (for example) will end up in a single data file. This means, for example, that a decoder in San Diego will receive all the material (event text descriptions, images, or any other objects) from all the other cities in the US and will be unable to discard useless material at the transport level. Consequently, in  
10 the absence of transport-level partitions, it is necessary for a decoder to filter received program guide information at the application level. This is a processor intensive, time-consuming and burdensome task that requires sophisticated software and significant processing power and raises the cost of a decoder unit.

15 The VLPG data structure of Figure 1 advantageously provides the option of employing area-based partitioning at the transport layer level. Program guide information may be partitioned in an Eastern area, a Central area, a Mountain area, and a Pacific area, for example. Then a decoder in San Diego would  
20 no longer need to receive program guide information from the other 3 regions. Therefore, such partitioning significantly reduces the parsing and filtering burden on a decoder and smaller partitions (e.g. on a state by state basis) further reduce the parsing and filtering burden. Another advantage of such  
25 partitioning is that the time involved in downloading applicable partitioned program guide information is reduced.

However, partitioning program guide information involves introducing redundant program guide data because such partitioning requires duplication of data items. As an example, if a  
30 basketball game is aired in the Pacific and Mountain regions, then two copies of associated text descriptive information need to be transmitted, one copy for each of the partitions targeted at the Pacific and Mountain regions. It can be seen that, as the number of partitions increases, the quantity of redundant information also  
35 increases necessitating larger transmission bandwidth. Consequently, there is a trade-off between bandwidth and the burden of information filtering. A large number of partitions imply fast information filtering but at the cost of increased bandwidth. When there is only one partition, there are no  
40 redundancies and therefore bandwidth is minimal but the filtering

5 burden is larger since all the program guide information items need to be parsed.

Time and area cells may be mapped into an MPEG-2 compatible data structure by using the MPEG2 PSI and DSM-CC fields. Not all of the tables may need to include area-based  
10 identifiers. Program content ratings, for example, are typically applicable everywhere in the US. In the VLPG architecture of Figure 1, significant advantage is obtained by applying area-based partitioning to the Channel Information Table (CIT) and the Master Guide Table. A CIT defines the channel line-up (list of  
15 available channels) for a service provider and depends on the geographical area covered by the service provider. The channel line-up for terrestrial broadcast in Indianapolis is different than the channel line-up for a cable provider in Philadelphia, for example. In the system of Figure 1 the MGT also depends on  
20 geographical area but this is not necessarily the case.

The capability of performing focused targeting of program guide information to particular audiences is one advantage derived from being able to make fine area-based divisions of channel line-ups at the broadcast market level. In  
25 order to accomplish this, different table "instances" are created. A table instance is a version of a table that is targeted to a particular market area and incorporates an area identifier for identifying the applicable market area. Multiple instances of a single table can be concurrently transmitted each carrying different information.  
30 Different table instances are recognized using the "table\_id\_extension" field of the MPEG-2 protocol.

Figures 2 and 3 show a Master Guide Table (MGT) format and Channel Information Table (CIT) format respectively for use in conveying program specific information and  
35 incorporating a table\_id\_extension field for market area identification. In the MGT of Figure 2 and in the CIT of Figure 3, this market area identification field is termed a "network\_provider" and is shown in the MGT data structure as item 130, and in the CIT data structure as item 140. The  
40 network\_provider area identifier field is a 16-bit field used to

10

5 uniquely identify a network provider. The meaning of the network provider depends on the transmission medium. Specifically, for terrestrial broadcast, a network provider is a collection of stations within a geographical region, for cable broadcast, a network provider is a local cable service provider and  
10 for satellite broadcast, a network provider is a satellite service provider.

The data structure of Figure 1 advantageously allows different types of program specific and program guide information to be targeted to different areas. This feature permits flexibility in  
15 selecting an acceptable compromise between decoder complexity and processing bandwidth involved in broadcasting and receiving the program guide data. As an example, it may be acceptable to partition multimedia objects into coarser areas than channel line-up information. The data structure of Figure 1 gives the guide  
20 providers the capability of partitioning different types of data in different gradations of area ranging from coarse areas to fine areas (e.g. areas as large as countries, states, or counties ranging to areas as fine as cities, towns, city blocks or even individual customers).

25 Further, program guide information may be collated in a decoder to provide a User a choice between program guides for different areas (e.g. between two neighboring areas or a choice of guides from any of the available areas) or for different periods of broadcast time. As such, a program guide may be selected in a  
30 decoder from one or more available program guides associated with different areas, in response to a User selection input via a remote unit or other data entry device. In performing such a selection, a decoder compares a region identification designation (associated with received program guide information) with a pre-  
35 stored region identification designation representing the decoder location. Such a region identification designation may comprise, a zip code, a telephone area code, and any other region identification code.

Figure 4 shows a multimedia object data structure  
40 format for conveying objects within a VLPG. The multimedia

11

5 object data structure supports area and time based partitioning through the use of area and time identifier fields within an MPEG DSM-CC compatible carouselId identifier (item 150 in Figure 4).

Figures 5, 6 and 7 show examples of the data structure of objects comprising channel, event and control objects  
10 respectively. Specifically, Figure 5 shows a Channel Basic Information File (channel BIF) binary file, Figure 6 shows an Event Basic Information File (Event BIF) binary file and Figure 7 shows a Control Basic Information File (Control BIF) binary file. In similar fashion to Figure 4, the channel, event and control object data of  
15 Figures 5-7 include area and time identifier fields within MPEG DSM-CC compatible carouselId identifiers (items 153, 157 and 159 of Figure 5-7 respectively).

Figure 8 item 152, shows an exemplary carouselId data structure for an MPEG compatible carouselId (as used in the  
20 tables of Figures 4, 5, 6 and 7). The carouselId includes a 16 bit directory item identifier for use as a data base reference, an 8 bit time identifier and an 8 bit area identifier. These fields enable a decoder to selectively filter program guide data based on area and time based partitions.

25 In the VLPG data structure of Figure 1, a Master Database Table (MDBT item 122) is used to define program guide partitions (cells) and to inform a decoder of the cells available in its location for decoding. Figure 9 shows a Master Database Table data structure incorporating hierarchical based version identifiers  
30 and cell partition identifiers advantageously enabling dynamic program guide re-partitioning. The code between items 170 and 178 comprises a loop that defines partitioned cells. Within this loop, the field called "cell\_type" (item 172) determines an index of a cell as illustrated in Figure 10.

35 Figure 10 item 179 shows an exemplary data structure for a cell type indicator. The cell type indicator includes an 8 bit complexity level identifier used to define a complexity level of an object. The cell type indicator also includes an 8 bit area identifier and an 8 bit time identifier for defining area and time based  
40 partitions.

12

5           An individual object or program guide information  
item includes a carouselId (as defined in Figure 8 and as shown  
item 150 in Figure 4) for linking the object to a time and area  
index of its mother cell. Dynamic program guide re-partitioning is  
achieved by re-arranging the cell list in the MDBT and by dynamic  
10 alteration in the mother cell time and area index identifiers within  
a carouselId. Consequently, a guide provider is able to  
dynamically re-partition a program guide data structure to adapt  
to changes in available transmission bandwidth or decoder  
sophistication. A guide provider may use finer partitions to  
15 provide faster object filtering times if increased bandwidth  
becomes available or may use coarser partitions to preserve  
bandwidth if decoder processing capabilities improve. As such, a  
decoder in San Diego may today have access to program guide  
information associated with areas 0 and 7 while in the future the  
20 decoder may be given access to program guide information  
associated with areas 0 and 9, reflecting finer partitioning, for  
example. In the future, it is entirely feasible to be able to provide  
real-time access to multimedia objects present in guides covering  
areas as large as the USA by selecting an appropriate compromise  
25 between bandwidth and partitioning.

Figure 11 shows a hierarchical directory format for an  
object database including object files under channel, event and  
control sub-directories. Figure 11 shows that a particular event  
such as "event2" can have its own directory containing its  
30 required files, e.g., "event2" has four associated objects (items 240,  
242, 244 and 246 in Figure 11). Using the object database a  
directory-based address is mapped into transport-level fields for  
processing. Given a path such as  
/VLPG/TIME1/AREA1/events/event2/event.bif, (path through  
35 directory items 220, 224, 228, 232, 238, 242 of Figure 11) for  
example, there is one and only one object with a certain  
carouselId and moduleId. For example, in this case, the following  
mapping applies:

40       /VLPG -----> Files extracted from VLPG object data base

13

5        /TIME1        ----->    0x01 (time variable)  
         /AREA1        ----->    0x01 (area variable)  
         /events/event2 --->      0x3005 (directory number variable).

         Therefore, this database address is mapped to a  
10 carouselId of 0x01013005. Further, the event.bif (item 242) has a  
      moduleId which may be determined from the program guide  
      information (such as value 0x0002 in this example). The inverse  
      mapping from transport-level fields to a directory-based address  
      is also unique and may be similarly derived.

15        The directory structure exemplified in Figure 11  
      supports the operation of software for processing and interacting  
      with transmitted objects. The processing software may be  
      transmitted in file form, together with objects, and then  
      interpreted or compiled and run by a decoder. Such processing  
20        software may be used for numerous applications including for  
      advantageously creating content-based program guides in a  
      decoder in a language such as HTML (Hyper Text Mark-up  
      Language), SGML (Standardized Generalized Mark-up Language),  
      Java, ActiveX and any other decoder supported language. As an  
25        example, each Sunday a guide provider may want to prepare a  
      web site describing all available Sunday movies for transmission  
      to decoder units containing a web browser and supporting HTML  
      software. The Sunday guide information is encoded in HTML and  
      transmitted to decoders as HTML software files that describe the  
30        special web site. The HTML files are located anywhere in the  
      directory structure of the Object Database and together generate  
      images, text, video, and audio files that form the Sunday movie  
      guide listing comprising the special web site. As such, the Sunday  
      guide web site is broadcast as part of an object database and is not  
35        conventionally accessed from an Internet server. Other special  
      program guide web sites that may be conveyed in this way may  
      list, for example, (a) a DVD/VCR programs available for play, (b)  
      other Internet web sites, (c) pre-stored fax/phone numbers for  
      access, (d) videophone functions and (e) home appliance control  
40        functions.

14

5           A User may initiate display of the special Sunday  
guide broadcast-web site contained in the Object Database by  
using a remote unit or other data entry device to select an  
associated displayed menu item or display icon and may similarly  
navigate the broadcast-web site and review the advertised  
10 movies. In addition, a User may be able to initiate commands via  
the web site such as (a) programming a VCR or DVD unit, (b)  
tuning to a desired channel, or (c) accessing other Internet sites  
that are either similarly broadcast as part of the object database  
or that are conventionally accessed via telephone (or cable) line.  
15 Further, in initiating such telephone (or cable) line Internet access  
a decoder may acquire access information from a broadcast or  
other source. Such access information includes (a) an Internet URL,  
(b) an Internet IP address, (c) an Email address, and (d) a  
telephone/fax/videophone number, for example.

20           The hierarchical directory structure of Figure 11  
illustrates another advantage offered by the VLPG structure of  
Figure 1. In a large program guide, managing the update of  
constituent tables and objects involves examining a large quantity  
of version numbers (thousands of version numbers may be  
25 involved). A decoder downloads a particular program guide table  
or object upon determination of a version number change and  
disregards those tables or objects where no version number  
change is indicated. This task may be aided by listing all the  
version numbers of tables and objects that are susceptible to  
30 change in one table such as a MGT. The MGT is broadcast at a  
sufficiently fast rate to enable a decoder to examine the MGT to  
determine which tables or objects have changed and to acquire a  
changed table or object in a timely fashion. However, parsing  
every entry in the MGT may become very time consuming in a  
35 large guide structure.

          This problem is addressed by employing a system of  
hierarchical version control in which there are several tables that  
perform version control. These tables are arranged in a tree  
structure as exemplified by Figure 11. In Figure 11, table 238  
40 (event2) controls the version of those tables/files under table 238.



15

5 Table 232 (events) controls all the versions of tables 336 (event1),  
and 238. Table 228 (AREAL) controls the versions of tables 230  
(channels), 232 and 236 (control) only. In this way, the version  
number information stored in each table is small and by  
traversing the tree from top to down, it is possible to quickly find  
10 those files, tables or objects that need to be updated.

Although a multiple-level structure is described above,  
a two layer version control structure may also be used for version  
control of objects in the database in the VLPG of Figure 1. In the  
two layer example, the upper layer of the tree hierarchy is the  
15 Master Database Table (MDBT) as exemplified in Figure 9. The  
second level, below the MDBT level, consist of cells comprising  
Channel, Event and Control Basic Information Files, as exemplified  
by the previously described data structures of Figures 5, 6 and 7  
respectively. A change in any of the Channel, Event or Control files  
20 is signaled by a change in their respective version numbers, item  
160 (Figure 5), item 163 (Figure 6) and item 167 (Figure 7).  
Further, any change in the Channel, Event or Control file version  
numbers is signaled by a change in the next hierarchical (cell)  
level version number i.e. such a change is signaled by a change in  
25 version number 176 in the MDBT of Figure 9. As a specific  
example, if a channel logo (which is an image in the database)  
changes from one version to another, then the channel BIF will  
reflect this change in item 160 (Figure 5). The MDBT will also  
signal the change in item 176 at the cell level (Figure 9). A  
30 decoder examines first the MDBT and determines the cell version  
number has changed and then examines the BIF files to identify  
objects that have changed within the cell.

The Master Data Base Table (MDBT) structure of Figure  
9 provides another advantage in processing large program guides.  
35 Decoder sophistication and processing power and ability to process  
complex multimedia objects evolves with time. For example, the  
first generations of set top box decoders were largely restricted to  
processing images in bit map form. However, newer generations of  
decoder may use decompression software to download JPEG, GIF  
40 or other image formats and future generations will be able to

16

- 5 process not only images but also movie clips in multiple formats. Consequently, it is desirable to structure program guide data to support decoder scalability i.e. to allow a range of decoders of varying complexity to process program guide information using the level of processing power that they are endowed with.
- 10 Thereby, low-complexity decoders are able to identify objects that they are able to process and to discard objects exceeding their processing capabilities. Otherwise high-complexity objects may impair the operation of low-complexity decoders by causing buffer overflow or other problems.
- 15 The MDBT data structure of Figure 9 (and Figure 10) advantageously supports efficient multimedia object complexity discrimination in a decoder unit. For this purpose, the MDBT assigns PID (packet identifier) values to cells in the database. In Figure 9, item 172 identifies a particular cell and is associated
- 20 with a PID value by item 174. Further, item 172 defines the 24-bit field `cell_type` that defines the time, area, and complexity coordinates of a cell (see Figure 10). As such, an object complexity level indicator is included in an MPEG-2 compatible transport-layer field. Thereby objects in the data base belonging to different
- 25 complexity levels are conveyed in streams identified by different PIDs. A decoder is pre-assigned a complexity level and the decoder applies the MDBT (specifically item 172) in selecting and caching the PID values for those cells with complexity levels that match or are below the pre-assigned decoder complexity level.
- 30 Objects of complexity level exceeding the decoders capabilities are advantageously discarded at the transport level.

Figure 12 shows a flowchart of a method for forming program specific information, according to the invention. The method of Figure 12 generates program specific information

35 including MGT, MDBT, CCT, STT, RRT, TCIT, CCIT, SCIT and SIT data and descriptors containing the advantageous features previously described. The method may be employed at an encoder for broadcasting program guide data or, may be employed for encoding program guide data within a decoder unit for

40 transmission to another device.

17

5           Following the start at step 250 of Figure 12, in step 253, a method based on the previously described data structuring principles is selected for partitioning program specific information. The program specific information is partitioned in accordance with time segments and areas, network types, complexity levels, cells,  
10 and programs (events). In step 255, PID values are assigned to accommodate the partitioned program specific information. If a non-MPEG transport protocol is used, PID values may be replaced by proper parameters that identify logical channels. In step 257 a MGT and MDBT (or other type of control tables) are generated to  
15 include those formed during partition operations. The MGT conveys information for use in acquiring program specific information conveyed in other tables. The MDBT conveys information for use in acquiring multimedia objects from a transport stream.

20           In step 260 individual CCT, STT, RRT, TCIT, CCIT, SCIT and SIT etc. tables are formed complying with the partitioned structure. The individual tables incorporate multimedia object links, version numbers and identifiers derived according to the previously described invention principles. A CIT (e.g. TCIT, CCIT  
25 and SCIT) is formed containing channel and program identification information enabling acquisition of available broadcast programs and channels containing packet identifiers for identifying individual packetized datastreams that constitute individual programs to be transmitted on particular channels. Further, in  
30 step 260, an SIT is generated containing program guide schedule information including descriptive lists of programs (events) receivable on the channels listed in the CIT.

          In step 263, the tables formed in step 260, together with associated multimedia objects, are formatted to be  
35 compatible with a desired data format and protocol. Such data formats and protocols include, for example, MPEG2 compatible Program Specific Information, MPEG2 DSM-CC, DSS, and an Internet compatible file transfer format. In step 265, the resulting formatted tables and multimedia objects are incorporated into a  
40 datastream in their designated locations for terrestrial

5 transmission. The MGT and MDBT are incorporated into the datastream in step 267.

10 In step 270, the program specific information produced in step 267, together with video and audio program representative components (and other data) for multiple channels, is multiplexed and formatted into a transport stream for output. In step 270, the output transport stream is further processed to be suitable for terrestrial transmission to another device such as a receiver, video server, or storage device for recording on a storage medium, for example. The processes performed in step 270  
15 include known encoding functions such as data compression Reed-Solomon encoding, interleaving, scrambling, trellis encoding, and carrier modulation. The process is complete and terminates at step 275. In the process of Figure 12, multiple CIT, SIT and associated extension tables may be formed and incorporated in the program  
20 specific information in order to accommodate expanded numbers of channels. Further, in other embodiments the tables may be similarly processed for satellite, cable or Internet transmission, for example.

In the video receiver system of Figure 13, a broadcast  
25 carrier modulated with signals carrying audio, video and associated data representing broadcast program content is received by antenna 10 and processed by unit 13. The resultant digital output signal is demodulated by demodulator 15. The demodulated output from unit 15 is trellis decoded, mapped into  
30 byte length data segments, deinterleaved and Reed-Solomon error corrected by decoder 17. The corrected output data from unit 17 is in the form of an MPEG compatible transport datastream containing program representative multiplexed audio, video and data components. The transport stream from unit 17 is  
35 demultiplexed into audio, video and data components by unit 22 which are further processed by the other elements of decoder system 100. In one mode, decoder 100 provides MPEG decoded data for display and audio reproduction on units 50 and 55 respectively. In another mode, the transport stream from unit 17  
40 is processed by decoder 100 to provide an MPEG compatible

5 datastream for storage on storage medium 105 via storage device 90.

A user selects for viewing either a TV channel (user selected channel-SC) or an on-screen menu, such as a program guide, by using a remote control unit 70. Controller 60 uses the  
10 selection information provided from remote control unit 70 via interface 65 to appropriately configure the elements of Figure 13 to receive a desired program channel for viewing. Controller 60 comprises processor 62 and processor 64. Unit 62 processes (i.e. parses, collates and assembles) system timing information and  
15 program specific information including program guide information. Processor 64 performs the remaining control functions required in operating decoder 100. Although the functions of unit 60 may be implemented as separate elements 62 and 64 as depicted in Figure 13, they may alternatively be  
20 implemented within a single processor. For example, the functions of units 62 and 64 may be incorporated within the programmed instructions of a microprocessor.

Controller 60 configures processor 13, demodulator 15, decoder 17 and decoder system 100 to demodulate and decode  
25 the input signal format and coding type. Further, controller 60 configures units 13, 15, and 17 for other communication modes, such as for receiving cable television (CATV) signals and for bi-directional communication via coaxial line 14 or for bi-directional (e.g. Internet) communication, for example, via telephone line 11.  
30 In an analog video mode, an NTSC compatible signal is received by units 13, 15 and 17 and processed by decoder 100 for video display and audio reproduction on units 50 and 55 respectively. Units 13, 15, 17 and sub-units within decoder 100 are individually configured for the input signal type by controller 60  
35 setting control register values within these elements using a bi-directional data and control signal bus C.

The transport stream provided to decoder 100 comprises data packets containing program channel data and ancillary system timing information and program specific  
40 information including program guide information. Unit 22 directs

20

5 the ancillary information packets to controller 60 which parses, collates and assembles this information into the previously described hierarchically arranged tables (as exemplified in Figure 1). Individual data packets comprising the User selected program channel SC are identified and assembled using the assembled  
10 program specific information. Further, the program specific information contains conditional access, network information and identification and linking data enabling the system of Figure 13 to tune to a desired channel and assemble data packets to form complete programs. The program specific information also  
15 contains data supporting the identification and assembly of the ancillary information.

The program specific and system timing information is assembled by controller 60 into multiple hierarchically arranged and inter-linked tables per the structure of Figure 1. The STT  
20 contains a time reference indicator and associated correction data sufficient for a decoder to establish a time of transmission of a program by a broadcast source. The MGT contains information for acquiring program specific information conveyed in other tables such as identifiers for identifying data packets associated with the  
25 other tables. The CIT (e.g. TCIT) contains information for tuning and navigation to receive a User selected program channel. The SIT contains descriptive lists of programs (events) receivable on the channels listed in the CIT. The RRT contains program content rating information such as the MPAA (Motion Picture Association  
30 of America) or V-chip compatible rating information that is collated by region (e.g. by country or by state within the USA). Additional program specific information describing and supplementing items within the hierarchical tables is conveyed within descriptor information elements. The program specific and  
35 system timing information acquired by controller 60 via unit 22 is stored within internal memory of unit 60. Controller 60 uses the acquired program guide information in conditioning access to programs and in scheduling program processing functions including program viewing, recording and playback.

21

5 Controller 60 and processor 22 determine from the CIT the PIDs of video, audio and sub-picture streams in the packetized decoded transport stream input to decoder 100 from unit 17. The video, audio and sub-picture streams constitute the desired program being transmitted on selected channel SC. Processor 22  
10 provides MPEG compatible video, audio and sub-picture streams to video decoder 25, audio decoder 35 and sub-picture processor 30 respectively. The video and audio streams contain compressed video and audio data representing the selected channel SC program content. The sub-picture data contains the SIT, CCT and  
15 RRT information associated with the channel SC program content.

Decoder 25 decodes and decompresses the MPEG compatible packetized video data from unit 22 and provides decompressed program representative pixel data to NTSC encoder 45 via multiplexer 40. Similarly, audio processor 35 decodes the  
20 packetized audio data from unit 22 and provides decoded and amplified audio data, synchronized with the associated decompressed video data, to device 55 for audio reproduction. Processor 30 decodes and decompresses sub-picture data received from unit 22.

25 Processor 30 assembles, collates and interprets RRT, CCT, CIT and data objects from unit 22 to produce formatted program guide data for output to OSD 37. OSD 37 processes the SIT, RRT, and CCT and other information to generate pixel mapped data representing subtitling, control and information menu  
30 displays including selectable menu options and other items for presentation on the display device 50. The control and information menus that are displayed enable a user to select a program to view and to schedule future program processing functions including a) tuning to receive a selected program for viewing, b)  
35 recording of a program onto storage medium 105, and c) playback of a program from medium 105.

The control and information displays, including text and graphics produced by OSD generator 37, are generated in the form of overlay pixel map data under direction of controller 60.  
40 The overlay pixel map data from unit 37 is combined and

22

5 synchronized with the decompressed pixel representative data  
from MPEG decoder 25 in encoder 45 via multiplexer 40 under  
direction of controller 60. Combined pixel map data representing a  
video program on channel SC together with associated sub-picture  
data is encoded by NTSC encoder 45 and output to device 50 for  
10 display.

In a storage mode of the system of Figure 13, the  
corrected output data from unit 17 is processed by decoder 100 to  
provide an MPEG compatible datastream for storage. In this mode,  
a program is selected for storage by a user via remote unit 70 and  
15 interface 65. Processor 22, in conjunction with processor 60 forms  
condensed program specific information including MGT, MDBT,  
CCT, STT, RRT, TCIT and SIT data and descriptors containing the  
advantageous features previously described. The condensed  
program specific information supports decoding of the program  
20 selected for storage but excludes unrelated information. Processor  
60, in conjunction with processor 22 forms a composite MPEG  
compatible datastream containing packetized content data of the  
selected program and associated condensed program specific  
information. The composite datastream is output to storage  
25 interface 95.

Storage interface 95 buffers the composite datastream  
to reduce gaps and bit rate variation in the data. The resultant  
buffered data is processed by storage device 90 to be suitable for  
storage on medium 105. Storage device 90 encodes the buffered  
30 datastream from interface 95 using known error encoding  
techniques such as channel coding, interleaving and Reed Solomon  
encoding to produce an encoded datastream suitable for storage.  
Unit 90 stores the resultant encoded datastream incorporating the  
condensed program specific information on medium 105.

35 The architecture of Figure 13 is not exclusive. Other  
architectures may be derived in accordance with the principles of  
the invention to accomplish the same objectives. Further, the  
functions of the elements of decoder 100 of Figure 13 and the  
process steps of Figure 12 may be implemented in whole or in  
40 part within the programmed instructions of a microprocessor. In



23

5 addition, the principles of the invention apply to any form of  
MPEG or non-MPEG compatible electronic program guide. A  
datastream formed according to the invention principles may be  
used in a variety of applications including video server or PC type  
communication via telephone lines, for example: A program  
10 datastream with one or more components of video, audio and data  
formed to incorporate program specific information according to  
invention principles may be recorded on a storage medium and  
transmitted or re-broadcast to other servers, PCs or receivers. The  
key elements of the data structure described herein may be  
15 advantageously used for conveying program ancillary information  
in a wide variety of data transport structures that may be used to  
deliver program content or program guide information. Such  
transport structures, for example, may include MPEG-PSI, Internet  
TCP/IP (Transport Control Protocol/Internet Protocol), DSS (Digital  
20 Satellite System), ATM (Asynchronous Transfer Mode) etc.

24

5 What is claimed is:

1. Apparatus for decoding packetized program information from a first source to provide a program guide, comprising:

10 a processor for acquiring ancillary and program guide information in said packetized program information, said ancillary information including,

(a) data for collating broadcast services by area, and

15 (b) data for collating program guide information associated with said broadcast services by scheduled time of broadcast, and

a data collator for collating said program guide information associated with said broadcast services using said  
20 ancillary information; and

a display processor for processing said collated program guide information for display.

2. Apparatus according to claim 1, wherein  
25 said area comprises at least one of (a) a geographic area, (b) an area served by a satellite, terrestrial, or cable broadcaster, and (c) a market area of a service provider.

3. Apparatus according to claim 1, wherein  
30 said data for collating broadcast services by area comprises at least one of (a) a channel information map associating particular broadcast channels with particular areas, and (b) a service information map associating particular services with particular areas.

35 4. Apparatus according to claim 3, wherein said services comprise at least two of

(a) video channels, (b) audio channels, (c) Internet service, (d) phone or fax service, (e) Wide Area Network service.

40

25

- 5           5. Apparatus according to claim 1, wherein  
said data for collating broadcast services by area  
associates particular broadcast channels with a region  
identification designation.
- 10           6. Apparatus according to claim 5, wherein  
said region identification designation comprises at  
least one of (a) a zip code, (b) a telephone area code, and (c)  
another region identification code, and  
said data collator collates program guide information  
15 by comparing said region identification designation with a pre-  
stored region identification designation of said apparatus.
7. Apparatus according to claim 1, wherein  
said ancillary information includes objects associated  
20 with said program guide information and includes information  
partitioned into tables, and  
said processor acquires data for collating said tables  
and objects by area.
- 25           8. Apparatus according to claim 7, wherein  
said data for collating said tables and objects includes  
region identification designations for associating objects with  
regions that are different to table regions, and  
said data collator collates said objects into regions  
30 different to regions of said tables.
9. Apparatus according to claim 7, wherein  
said object comprises at least one of (a) a video  
segment, (b) an audio segment, (c) text, (d) an icon representing a  
35 user selectable item for display, (e) an HTML or SGML document  
(f) a menu of selectable items, (g) an image window for  
presentation within an encompassing image, and (h) an image  
window for initiating a multimedia function.

26

5           10. Apparatus according to claim 1, wherein  
said ancillary information further includes acquisition  
information for use in acquiring said ancillary information from a  
second source different to said first source, and

          said acquisition information includes one of (a) an  
10 Internet URL, (b) an Internet IP address, (c) an Email address, and  
(d) a telephone/fax/videophone number.

          11. Apparatus according to claim 1, wherein  
said data for collating broadcast services by area is  
15 formed in accordance with MPEG protocol and uses at least one  
data field selected from, (a) a table\_id\_extension field, (b) a  
carouselId field, and (c) a User defined private data field.

          12. Apparatus according to claim 1, wherein  
20 said data collator collates said program guide  
information in response to a User selection input to provide a  
program guide selected from at least two available program  
guides associated with different areas.

25           13. Apparatus according to claim 1, wherein  
said ancillary information includes information  
identifying an area applicable to said apparatus, and  
said apparatus is excluded from decoding broadcast  
services outside of said identified applicable area.

30           14. Apparatus according to claim 13, wherein  
said information identifying an applicable area is  
susceptible to being dynamically re-assigned to identify a  
different area, and

35           said data collator adapts to decode broadcast services  
associated with said different area in response to said area change.

27

- 5           15. Apparatus for decoding packetized program  
information from a first source to provide a program guide,  
comprising:
- a processor for acquiring ancillary and program guide  
information in said packetized program information, said ancillary  
10 information including,
- (a) data for collating broadcast services by area,  
and
- (b) data for collating program guide information  
associated with said broadcast services by scheduled time of  
15 broadcast, and
- a data collator for collating program guide information  
in response to a User selection input to provide a program guide  
selected from at least two available program guides associated  
with different areas; and
- 20           a display processor for processing said collated  
program guide information for display.
16. A storage medium containing digital data  
representing video information comprising:
- 25           packetized program information representing a video  
program; and
- ancillary information including ancillary and program  
guide information in said packetized program information, said  
ancillary information including,
- 30           (a) data for collating tables and objects  
associated with broadcast services, and
- (b) data for collating program guide information  
associated with said broadcast services, and
- information for associating said tables and objects with  
35 program guide information items associated with said broadcast  
services.

28

5           17. Apparatus according to claim 16, wherein  
said data for collating tables and objects includes an  
program information map linking said objects with program guide  
information items associated with programs broadcast on  
particular broadcast channels.

10

18. A method for forming program guide information  
to be suitable for processing in a decoder to provide different  
program guides displaying different service listings in  
correspondingly different regions, comprising the steps of:

15           forming ancillary information including,

          (a) data for collating broadcast services by area,  
and

          (b) data for collating program guide information  
associated with said broadcast services by scheduled time of  
20 broadcast, and

forming linking information associating programs with  
said broadcast services; and

          incorporating said ancillary information and said  
linking information into packetized data for output to a  
25 transmission channel.

19. A method according to claim 18, wherein  
said area comprises at least one of (a) a geographic  
area, (b) an area served by a satellite, terrestrial, or cable  
30 broadcaster, and (c) a market area of a service provider.

20. A method according to claim 18, wherein  
said data for collating broadcast services by area  
comprises at least one of (a) a channel information map  
35 associating particular broadcast channels with particular areas,  
and (b) a service information map associating particular services  
with particular areas.

29

- 5           21. A method according to claim 18, wherein  
said data for collating broadcast services by area  
associates particular broadcast channels with a region  
identification designation.
- 10           22. A method according to claim 21, wherein  
said region identification designation comprises at  
least one of (a) a zip code, (b) a telephone area code, and (c)  
another region identification code.
- 15           23. A method according to claim 18, including the step  
of  
forming said ancillary information into tables  
partitioned based on area and scheduled broadcast time.
- 20           24. A method according to claim 18, wherein  
said ancillary information includes an object associated  
with said program guide information.
- 25           25. A method according to claim 24, wherein  
said object comprises at least one of (a) a video  
segment, (b) an audio segment, (c) text, (d) an icon representing a  
user selectable item for display, (e) an HTML or SGML document  
(f) a menu of selectable items, (g) an image window for  
presentation within an encompassing image, and (h) an image  
30 window for initiating a multimedia function.
26. A method according to claim 18, including the step  
of  
forming ancillary information partitioned into tables  
35 and including data for collating objects and said tables, and  
including region identification designations for  
associating objects with regions that are different to table  
regions.

30

5 27. A method according to claim 18, including the step  
of

forming said ancillary information to include  
information associating a particular area with at least one  
particular decoder for decoding said ancillary information.

10

28. A method according to claim 27, wherein  
said particular decoder is associated with said  
particular area using a unique decoder identification code.

15

29. A method according to claim 27, including the step  
of

dynamically updating said information associating a  
particular area with at least one particular decoder to associate a  
different area with said particular decoder.

20

30. Apparatus according to claim 18, wherein  
said data for collating broadcast services -by area is  
formed in accordance with MPEG protocol and uses at least one  
data field selected from, (a) a table\_id\_extension field, (b) a  
25 carouselld field, and (c) a User defined private data field.



31

5           31. A method for decoding packetized program information from a first source to provide a program guide, comprising the steps of:

          acquiring ancillary and program guide information in said packetized program information, said ancillary information  
10 including,

          (a) data for collating broadcast services by area,  
and

          (b) data for collating program guide information associated with said broadcast services by scheduled time of  
15 broadcast, and

          collating said program guide information associated with said broadcast services using said ancillary information; and  
          processing said collated program guide information for display.

20

          32. A method for decoding packetized program information from a first source to provide a program guide, comprising the steps of:

          acquiring ancillary and program guide information in  
25 said packetized program information, said ancillary information including,

          (a) data for collating broadcast services by area,  
and

          (b) data for collating program guide information  
30 associated with said broadcast services by scheduled time of broadcast, and

          collating program guide information in response to a User selection input to provide a program guide selected from at least two available program guides associated with different  
35 areas; and

          processing said collated program guide information for display.

1/11

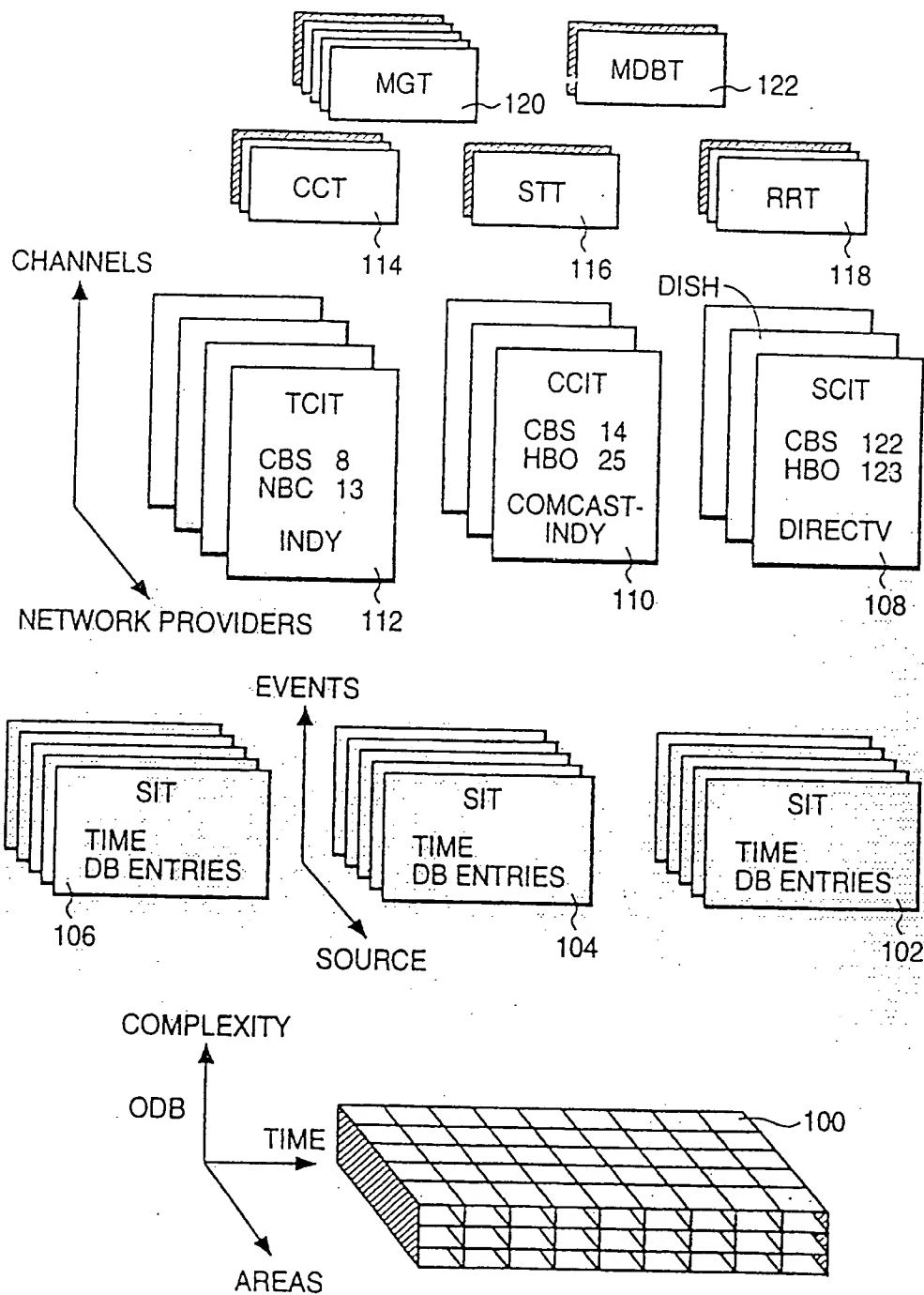


FIG. 1

2/11

SYNTAX	BITS	FORMAT
master_guide_table_section () {		
table_id	8	0x91
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
network_provider	16	uimsbf
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	'1'
section_number	8	0x00
last_section_number	8	0x00
protocol_version	8	uimsbf
number_networks_defined	16	uimsbf
table_types_defined	16	uimsbf
for (i=0; <table_types_defined; i++){		
table_type	16	uimsbf
reserved	3	'111'
table_type_PID	13	uimsbf
reserved	3	'111'
table_type_version_number	5	uimsbf
number_bytes	32	uimsbf
reserved	4	'1111'
table_type_descriptors_length	12	uimsbf
for (k=0; k<N; k++){		
descriptor()	var	
}		
reserved	4	'1111'
descriptors_length	12	uimsbf
for (l = 0; l<N; l++){		
descriptor()	var	
CRC_32	32	rpchof
}		

FIG. 2

3/11

SYNTAX	BITS	FORMAT
terrestrial_channel_information_table_section () {		
table_id	8	0x95
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
network_provider	16	uimsbf
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
protocol_version	8	uimsbf
num_channels_in_section	8	uimsbf
for (i=0;i<num_channels_in_section;i++){		
short name	7*16	unicode BMP
reserved	4	'1111'
major_channel_number	10	uimsbf
minor_channel_number	10	uimsbf
modulation_mode	8	uimsbf
carrier_frequency	32	uimsbf
channel_TSID	16	uimsbf
program_number	16	uimsbf
access_controlled	1	bslbf
hidden	1	bslbf
reserved	8	0xFF
service_type	6	uimsbf
source_id	16	uimsbf
carousel_id	32	uimsbf
reserved	6	'111111'
descriptors_length	10	uimsbf
for (i=0;i<N;i++) {		
descriptors()		
}		
}		
reserved	6	'111111'
additional_descriptors_length	10	uimsbf
for(j=0;j<N;j++) {		
additional_descriptors()		
}		
CRC_32	32	rpchof
}		

FIG. 3

4/11

SYNTAX	BITS	FORMAT
multimedia_object_section () {		
table_id	8	0x3C
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
moduleId	16	uimsbf
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	'1'
section_number	8	uimsbf
last_section_number	8	uimsbf
protocolDiscriminator	8	0x11
dsmccType	8	0x03
messageId	16	0x1003
carouselId	32	uimsbf
reserved	8	0xFF
adaptionLength	8	0x00
messageLength	16	uimsbf
moduleId	16	uimsbf
moduleVersion	16	uimsbf
reserved	8	uimsbf
blockNumber	8	0xFF
Object_data ()	16	uimsbf
CRC_32	32	rpchof
}		

FIG. 4

5/11

SYNTAX	BITS	FORMAT
channel_basic_information_file_section () {		
table_id	8	0x3C
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
moduleId	16	0x0001
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	'1'
section_number	8	0x00
last_section_number	8	0x00
protocolDiscriminator	8	0x11
dsmccType	8	0x03
messageId	16	0x1003
carouselId	32	uimsbf
reserved	8	0xFF
adaptionLength	8	0x00
messageLength	16	uimsbf
moduleId	16	0x0001
moduleVersion	8	uimsbf
reserved	8	0xFF
blockNumber	16	0x0000
number_modules	16	uimsbf
for (i=0;i<number_modules;i++){		
moduleId	16	uimsbf
number_blocks	16	uimsbf
reserved	4	'1111'
moduleSize	28	uimsbf
moduleVersion	8	uimsbf
}		
reserved	4	'1111'
descriptors_length	12	
for (i=0;i<N;i++) {		
descriptor()		
}		
CRC_32	32	rpchof
}		

FIG. 5

6/11

SYNTAX	BITS	FORMAT
event_basic_information_file_section () {		
table_id	8	0x3C
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
moduleId	16	0x0002
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	'1'
section_number	8	0x00
last_section_number	8	0x00
protocolDiscriminator	8	0x11
dsmccType	8	0x03
messageId	16	0x1003
carouselId	32	uimsbf
reserved	8	0xFF
adaptionLength	8	0x00
messageLength	16	uimsbf
moduleId	16	0x0002
moduleVersion	8	uimsbf
reserved	8	0xFF
blockNumber	16	0x0000
title_length	8	uimsbf
title_text()	var	
number_modules	16	uimsbf
for (i=0;i<number_modules;i++) {		
moduleId	16	uimsbf
number_blocks	16	uimsbf
reserved	4	'1111'
moduleSize	28	uimsbf
moduleVersion	8	uimsbf
}		
reserved	4	'1111'
descriptors_length	12	
for (i=0;i<N;i++) {		
descriptor()		
}		
CRC_32	32	rpchof
}		

FIG. 6

7/11

SYNTAX	BITS	FORMAT
control_basic_information_file_section () {		
table_id	8	0x3C
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
moduleId	16	0x0003
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	'1'
section_number	8	0x0000
last_section_number	8	0x0000
protocolDiscriminator	8	0x11
dsmccType	8	0x03
messageId	16	0x1003
carouselId	32	uimsbf
reserved	8	0xFF
adaptionLength	8	0x00
messageLength	16	uimsbf
moduleId	16	0x0003
moduleVersion	8	uimsbf
reserved	8	0xFF
blockNumber	16	0x0000
number_modules	16	uimsbf
for (i=0;i<number_modules;i++) {		
moduleId	16	uimsbf
number_blocks	16	uimsbf
reserved	4	'1111'
moduleSize	28	uimsbf
moduleVersion	8	uimsbf
}		
reserved	4	'1111'
descriptors_length	12	
for (i=0;i<N;i++) {		
descriptor()		
}		
CRC_32	32	rpchof
}		

FIG. 7

	MSB				LSB	
Bit	31	24	23	16	15	0
carouselId	time		area		dirNumber	

FIG. 8



8/11

SYNTAX	BITS	FORMAT
master_database_table_section () {		
table_id	8	0x92
section_syntax_indicator	1	'1'
private_indicator	1	'1'
reserved	2	'11'
section_length	12	uimsbf
table_id_extension	16	0x0000
reserved	2	'11'
version_number	5	uimsbf
current_next_indicator	1	'1'
section_number	8	uimsbf
last_section_number	8	uimsbf
protocol_version	8	uimsbf
number_cells_defined	24	uimsbf
number_cells_in_section	24	uimsbf
for (i=0;i<number_cells_in_section;i++) {		
cell_type	24	uimsbf
reserved	3	'111'
cell_type_PID	13	uimsbf
reserved	3	'111'
cell_type_version_number	5	uimsbf
number_bytes	32	uimsbf
reserved	4	'1111'
cell_type_descriptors_length	12	uimsbf
for (k=0;k<N;k++)		
descriptor()	var	
}		
CRC_32	32	rpchof
}		

FIG. 9

	MSB				LSB	
Bit	23	16	15	8	7	0
cell_type	time		area		complexity	

FIG. 10

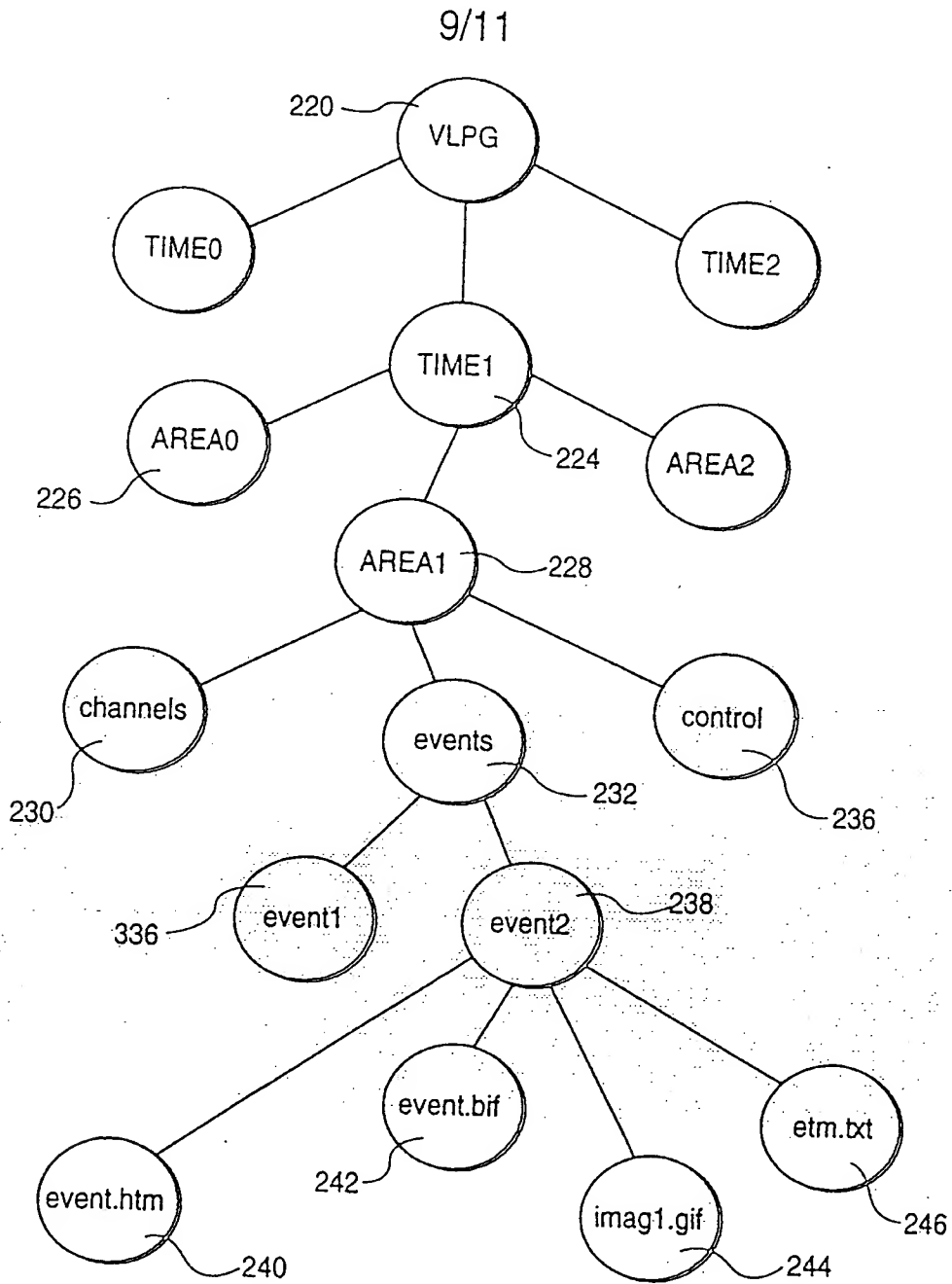


FIG. 11

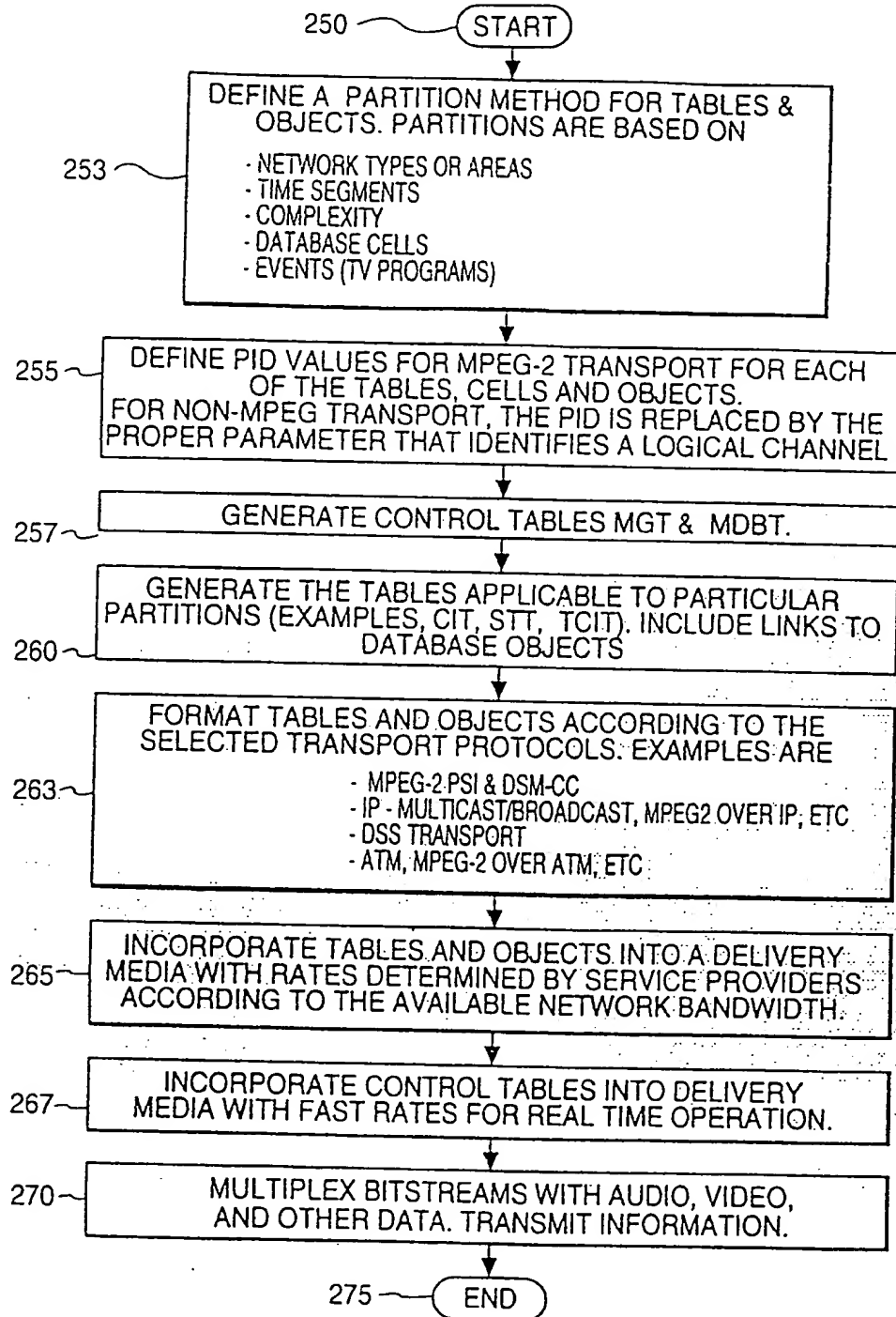


FIG. 12

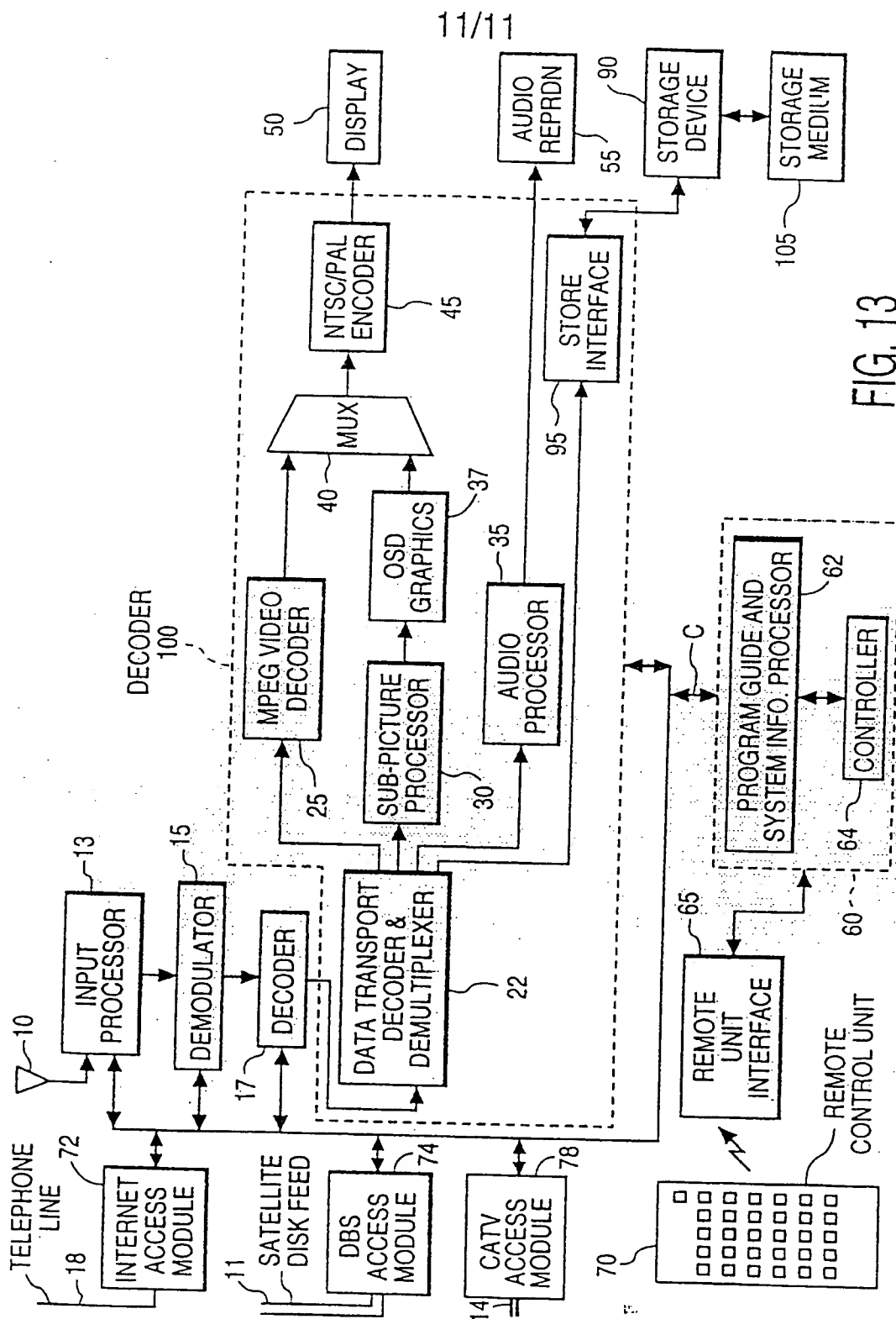


FIG. 13

## INTERNATIONAL SEARCH REPORT

Inter national Application No.

PCT/US 99/03513

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 H04N7/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	WO 96 41471 A (TV GUIDE ON SCREEN) 19 December 1996  see page 5, line 3 - line 31 see page 6, line 21 - line 28	1, 2, 5, 6, 13, 31 4, 5, 7, 9, 10, 25 19, 21, 22, 27, 28
A	WO 96 27982 A (KWOH DANIEL S ; LEUNG ELSIE Y (US); MANKOVITZ ROY J (US); YUEN HENR) 12 September 1996 see page 4, line 7 - line 16 see page 4, line 27 - line 36  -/-	1, 6, 22

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"Z" document member of the same patent family

Date of the actual completion of the international search

31 May 1999

Date of mailing of the international search report

10/06/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Sindic, G

## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 99/03513

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	HARTWIG S ET AL: "BROADCASTING AND PROCESSING OF PROGRAM GUIDES FOR DIGITAL TV" SMPTE JOURNAL, vol. 106, no. 10, 1 October 1997, pages 727-732, XP000727504 see page 728, left-hand column, paragraph 1 - paragraph 2 see page 729, right-hand column, paragraph 2 - page 730, left-hand column, paragraph 1 see figure 2	1,11,15, 16,18, 30-32
Y	WO 97 41690 A (AWARD SOFTWARE INTERNATIONAL I) 6 November 1997	10
A	see page 3, line 35 - page 4, line 21	18
A	WO 97 13368 A (BRIEN SEAN ANDREW O ;MILNES KENNETH ALAN (US); SCHEIN STEVEN MICHA) 10 April 1997 see page 18, line 33 - page 19, line 9 see page 26, line 32 - page 27, line 3	10,18
Y	THRIFT P ET AL: "JTV - Java-enabled Television" PROCEEDINGS OF THE SPIE, vol. 3228, 4 November 1997, pages 117-122, XP002090497	7,9,10
A	see page 118, line 28 - line 35 see page 120, line 16 - page 121, line 3	16,18, 24,25
Y	KUWABARA T., ET AL: "Satellite Multimedia Information Distribution Systems and Applications" PROCEEDINGS OF 19TH PACIFIC TELECOMMUNICATIONS CONFERENCE (PTC'97), 19 - 22 January 1997, pages 180-188, XP002104292 Honolulu, Hi, USA	4,5,25
A	see page 180, right-hand column, paragraph 2 - page 181, right-hand column, paragraph 1 see page 185, right-hand column, paragraph 2	1,2,7,9, 13,16, 19,21

# INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No.

PCT/US 99/03513

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9641471 A	19-12-1996	US 5760821 A	02-06-1998
		AU 6333696 A	30-12-1996
		BR 9609082 A	02-02-1999
		CA 2223162 A	19-12-1996
		EP 0852097 A	08-07-1998
		PL 323874 A	27-04-1998
WO 9627982 A	12-09-1996	AU 4966396 A	23-09-1996
		CA 2214762 A	12-09-1996
		CN 1186585 A	01-07-1998
		EP 0813791 A	29-12-1997
		JP 11501782 T	09-02-1999
		US 5559550 A	24-09-1996
WO 9741690 A	06-11-1997	EP 0896774 A	17-02-1999
WO 9713368 A	10-04-1997	AU 7387196 A	28-04-1997
		CA 2232003 A	10-04-1997
		CN 1200221 A	25-11-1998
		EP 0880856 A	02-12-1998
		JP 10512420 T	24-11-1998

**THIS PAGE BLANK (USPTO)**